New Capabilities through Partnerships

Livermore's partnering activities span a wide range—from very-large-scale strategic alliances to licensing of individual technologies, academic research, and support for the small business community. Partnerships and collaborations often help us accomplish our programmatic goals more efficiently and cost effectively.

The high-power solid-state green laser developed at the Laboratory has a variety of precision machining applications because of its exceptional performance and reliability compared with those of commercial copper-vapor lasers. It also can be used to pump ultrashort-pulse lasers, create laser displays, and treat disfiguring skin conditions such as port-wine stains. The technology won an R&D 100 Award.

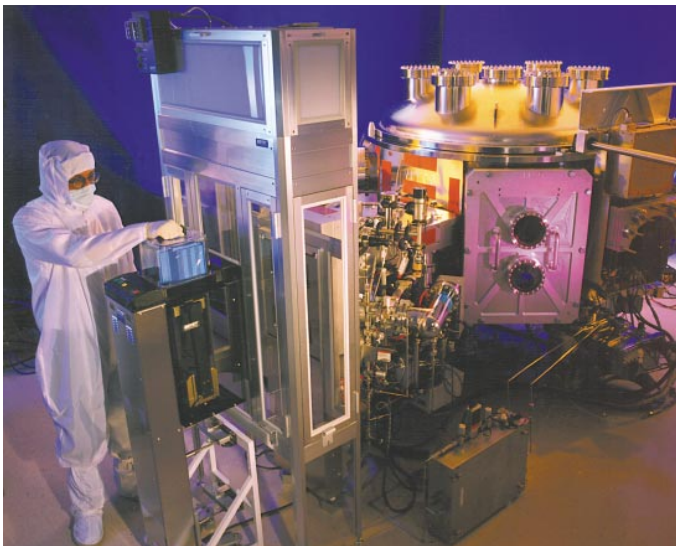
Technology Development with Industry

The Laboratory is acquiring mission-critical capabilities through major partnerships with U.S. industry, such as the Accelerated Strategic Computing Initiative and construction of the National Ignition Facility. We also enhance critical capabilities needed at the Laboratory for our national security mission through partnerships. In areas such as health care and environmental remediation, we "spin off" technologies for public benefit through cooperative research and development agreements (CRADAs) and licensing. Our many and varied interactions with U.S. industry are exemplified by Livermore's 98 active licensing agreements, 194 reported inventions, 105 patent applications, and 76 issued patents in fiscal year 1999.

Improving Designs and Measurements for EUVL

Teamed together as a Virtual National Laboratory (VNL), researchers from the Lawrence Livermore, Sandia, and Lawrence Berkeley national laboratories are working with an industrial consortium to develop the next-generation technology for semiconductor manufacturing. We are pursuing extreme-ultraviolet lithography (EUVL) as a means for etching ultrathin patterns into silicon chips with a hundredfold performance improvement over those produced with today's technology. The research and development effort by the VNL is a $250-million, multiyear CRADA partnership with the EUV LLC (Limited Liability Corporation) consortium consisting of Intel, AMD, Motorola, and Micron.

The VNL is currently focused on building and integrating the necessary technologies into an engineering test stand that will function as a prototype EUVL system. Livermore leads the efforts in the test stand's optical systems and components, thin films, masks, and submicrometer



The Ultra Clean Ion Beam Sputter Deposition System, developed at the Laboratory, is used to produce precise, uniform, highly reflective lithography masks. A key requirement of the next-generation lithography system is that it produce virtually defect-free masks. The system contributes fewer than 0.1 defect per square centimeter to each mask. The ultimate goal for extreme ultraviolet lithography is to add no more than 0.001 defect per square centimeter to a finished wafer blank.

metrology. In support of EUVL, further development of Livermore's precision deposition system won a 1999 R&D 100 Award. This year, shield design and other operational improvements were also made.

Optics teams are also working on advanced designs for projection optics, the optical heart of the lithographic exposure system. In addition, the Livermore metrology team is improving the capability to measure errors—from 0.35 to 0.15 nanometer—in the overall surface shape of aspherical optics.

PEREGRINE Goes Commercial

PEREGRINE, a revolutionary tool for analyzing and planning radiation treatment for cancer patients, will be appearing in hospitals within the next few years. Livermore has selected the NOMOS Corporation as a partner to transfer this unique system from the Laboratory into medical clinics. An R&D 100 Award winner in 1999, PEREGRINE will help a doctor to plan radiation treatment on a patient-specific basis using a readily affordable PC-like machine. Compared with other dose calculation methods in current use, PEREGRINE can more exactly estimate the radiation being delivered to a tumor and nearby tissue because the modeling explicitly accounts for inhomogeneities in the body such as air, muscle, and bone that are identified on the patient's computed tomography (CT) scan.

Radar Technology Patents Upheld

After reexamination, the U.S. Patent and Trademark Office upheld all 20 original claims by the Laboratory in its patent for the micropower impulse radar technology, or MIR. The versatile technology has the potential for enabling a wide range of low-cost instrumentation, and the Laboratory has entered into 28 licensing agreements with companies that want to use MIR in applications.

Livermore and other DOE researchers are applying laser-based processing techniques to the production of plastic flat-panel displays. In this project for the Defense Advanced Research Projects Agency, thin-film transistors are applied to thin, flexible plastic sheets in a fabrication process that combines low-temperature deposition techniques with the use of ultraviolet pulsed beams so precise and fast that the plastic does not melt.